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Optical emission cross section and excitation function for the $D^2\pi_g \rightarrow A^2\pi_u$ bands of $N_2^+$ produced by electron impact on $N_2$ molecules have been measured. Analysis of the results indicates the difference in the production mechanisms for the $N_2^+(D^2\pi_g)$ state as compared to the production mechanisms for the $N_2^+(A^2\pi_u)$ and $N_2^+(B^2\Sigma_u^+)$ states.

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# Final Report

## Collisional Processes Involving Atmospheric Gases

AFOSR Grant F49620-92-J-0376

We have studied the production of the $D^2\pi_g \rightarrow A^2\pi_u$ emission bands of $N_2^+$ by electron impact on the $N_2$ molecule. The $D^2\pi_g \rightarrow A^2\pi_u$ bands are very weak and we are not able to obtain satisfactory data by the conventional analog detection technique. A photon counting system for measuring the molecular emission band has been constructed and used to measure the optical emission cross sections of the (7,8), (9,8), and (4.5) bands of the $N_2^+(D^2\pi_g \rightarrow A^2\pi_u)$ emission and their excitation function. Out measured excitation functions are found to peak at 200 eV in contrast to the known excitation functic s for the $N_2^+(A^2\pi_u \rightarrow X^2\Sigma_g^+)$ and $N_2^+(B^2\Sigma_u^+ \rightarrow X^2\Sigma_g^+)$ bands which peak at 100 eV. This result underscores the difference in the production mechanisms for the $N_2^+(D^2\pi_g)$ states as compared to the production mechanisms for the $N_2^+(A^2\pi_u)$ and $N_2^+(B^2\Sigma_u^+)$ states.